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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/932,986	08/21/2001	Mark S.F. Clarke	USRA-SWCNT VI	6829

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EXAMINER	
LISH, PETER J	

ART UNIT	PAPER NUMBER
1754	4

DATE MAILED: 02/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/932,986	CLARKE ET AL.	
	Examiner	Art Unit	
	Peter J Lish	1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 June 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-36* is/are pending in the application.

4a) Of the above claim(s) *21-36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,15-18 and 20* is/are rejected.

7)☒ Claim(s) *12-14 and 19* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a)☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper N
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-20, drawn to a method of dispersing single-walled nanotubes, classified in class 423, subclass 447.1.

II. Claims 21-26, drawn to a solution of single-walled nanotubes, classified in class 423, subclass 447.2.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can be made by a materially different process, such as functionalizing the sidewall of the nanotubes and adding to water.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group II is not required for Group I, restriction for examination purposes as indicated is proper.

During a telephone conversation with Andy Ollig on 2/10/2003 a provisional election was made without traverse to prosecute the invention of Group I, claims 1-20. Affirmation of this election must be made by applicant in replying to this Office action. Claims 21-36 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 7 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 7 recites the use of Nonidet P-40 and Poloxamer 188, which are trademarks.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6, 17, and 20 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Bonard et al. ("Purification and Size-Selection of Carbon Nanotubes") with Allen ("Emulsions") to show a state of fact.

Bonard et al. disclose a method of maintaining stable suspensions of well-separated and purified nanotubes using such surfactants with high surfactant activity as sodium dodecyl sulfate (SDS), NP-10, and Span 80. The dispersal of water-nanotube suspensions stabilized with SDS are very dependent on the critical micellar concentration (CMC) of the surfactant. The optimum dispersal was reached at slightly above 100% of the CMC, and tests show that below this amount, for example at 40% of the CMC, the total amount of suspended nanotubes is smaller. Regarding claim 6, the hydrophilic-lipophilic balance of Span 80 is 4.3 (see Allen, Loyd Jr. "Emulsions"). Bonard et al. also teach that the nanotube suspensions may be passed through a filter to form a purified filtrate. While Bonard et al. do not explicitly teach that the nanotubes are single-walled nanotubes, it is expected that at least a portion of the nanotubes are single-walled because they are produced by an arc-discharge process, which is known to produce single-walled nanotubes. Alternatively, it would have been obvious to one of ordinary skill at the time of invention to use single-walled carbon nanotubes in the process of Bonard et al.

Claims 1 and 8 are rejected under 35 U.S.C. 102(a) as being anticipated by Chen et al. ("Cyclodextrin-Mediated Soft Cutting of Single-Walled Carbon Nanotubes").

Chen et al. disclose a method whereby the aqueous dispersion of single-walled nanotubes may be obtained by sonication with cyclodextrin in deionized water. It is believed that the

cyclodextrins are adsorbed at the surface of nanotube ropes by van der Waals force and act as excellent nanotube dispersing agents.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ("Fullerene Pipes) in view of the Sigma Product Information Sheet for Triton X-100 to show a state of fact.

Liu et al. disclose that stable colloidal suspensions of single-walled carbon nanotubes may be produced using surfactants such as SDS or the nonionic surfactant Triton X-100. Liu et al. does not explicitly disclose the use of the nonionic surfactant Nonidet P-40. The Sigma Product Information Sheet for Triton X-100 states that Triton X-100 has a structure very similar to that of Nonidet P-40 and the names are sometimes reported as synonyms. It therefore would have been obvious to one of ordinary skill in the art at the time of invention to substitute Nonidet P-40 into the teaching of Liu et al. because its properties are nearly identical to that of Triton 100-X.

Claims 1 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shibuta (USPN 5,853,877).

Shibuta discloses a process for the disentanglement and dispersal of carbon nanotubes. Shibuta teaches that the nanotubes are mixed in a solution of a strong acid containing sulfur and an organic solvent such as sulfonic acid. Shibuta teaches that the strong sulfuring acid is preferably in extremely high concentrations, however he does not explicitly teach the concentration of the organic solvent. The determination of the optimum concentration of organic solvent, being found by routine experimentation, is viewed to be the optimization of a known process, held to be obvious to one of ordinary skill by *In re Boesch* (205 USPQ 215) unless significantly unexpected and different results are obtained. Shibuta does not explicitly teach that the carbon nanotubes are single-walled nanotubes, although it would appear that some may be given his teaching that diameters may be as small as 3.5 nm. However, it would have been obvious to one of ordinary skill at the time of invention to use single-walled nanotubes in the process of Shibuta as they also are found in ropes and agglomerates.

Regarding claim 16, Shibuta teaches that benzenesulfonic acid and toluenesulfonic acid are examples of the sulfonic acids which may be used as an organic solvent. Shibuta does not explicitly teach the use of heptane-sulfonic acid or octane-sulfonic acid. However, as these are known examples of sulfonic acids, and considering that Shibuta extends his teaching to any sulfonic acids, it would have been obvious to one of ordinary skill at the time of invention to use either heptane-sulfonic acid or octane-sulfonic acid in the process of Shibuta.

Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. ("Cyclodextrin-Mediated…").

Chen et al. is applied as above. Chen et al. do not explicitly teach the concentration of cyclodextrin used to create a dispersed aqeous suspension of single-walled nanotubes when they are sonicated in water. However, the determination of the optimum concentration of dispersal agent, being found by routine experimentation, is viewed to be the optimization of a known process, held to be obvious to one of ordinary skill by *In re Boesch* (205 USPQ 215) unless significantly unexpected and different results are obtained.

Regarding claim 11, While Chen et al. do teach the use of Beta-cyclodextrin, they do not explicitly teach the use of methyl-Beta-cyclodextrin or 2-hydroxypropyl-Beta-cyclodextrin. However, in that it is taught that the Beta-cyclodextrin composition is an excellent dispersal agent for carbon nanotubes, it would have been obvious to one of ordinary skill at the time of invention to use this composition in various manipulations, such as methyl-B-cyclodextrin.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bonard et al. as applied to claims 1 and 17 above, and further in view of de Heer et al. ("Aligned carbon nanotube films…").

Bonard et al. do not explicitly teach the use of filters with pore sizes of no greater than 0.20 microns. De Heer et al. teach a process of filtering carbon nanotubes from suspension by drawing them through a 0.20 micron pore ceramic filter. It would have been obvious to one of ordinary skill at the time of invention to use the filter of de Heer et al. in the process of Bonard et al. to achieve a higher degree of nanotube separation by sizes.

Allowable Subject Matter

Claims 12-14 and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 703-308-1772. The examiner can normally be reached on 9:00-6:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 703-308-3837. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-305-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

PL
February 20, 2003

STUART L. HENDRICKSON
PRIMARY EXAMINER